EXPLORING THE ATTENTIONAL MODULATION OF NEURAL CODES

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Several experiments have shown that neuronal activity can be modulated by attention even while the sensory stimulus is held constant. This modulation implies changes on the tuning curve (or receptive field) of the neurons involved in sensory processing. We propose an information-theoretic hypothesis for the purpose of this modulation, and show using computer simulation that the same modulation appears in a system that is optimally encoding a sensory stimulus as the system is informed about the changing relevance of different features of the input. Specifically, we present a simple model that learns a covert attention mechanism, given input patterns and tradeoff requirements. We show that, after optimization, the system gains the ability to reorganize its computational resources (or coding strategy) depending on the incoming covert attentional signal, and that the modulation of activity of the encoding units for different attentional states qualitatively matches that observed in animal selective attention experiments.

The model we propose is not confined to visual attention, or to spatial attention. Instead, due to its generality, the model can be applied to any modality, and to any attentional goal.

Additional material for reviewers:

http://www-bcl.cs.may.ie/%7Ebarak/papers/sfn-2003-attention-poster.pdf

http://www-bcl.cs.may.ie/%7Ebarak/papers/cns-2003-attention.pdf